

More on Rates of Reaction

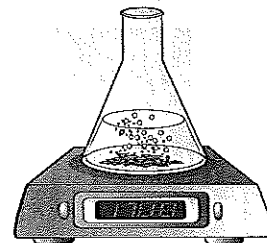
- Q1** Marble chips react with acid to produce carbon dioxide gas. This loss of gas means that the reaction can be followed by recording the mass every 30 seconds on a balance.

The experiment was repeated using different sized pieces of marble:

Experiment 1 large chips

Experiment 2 small chips

Experiment 3 powdered marble



- a) In carrying out this experiment, what factors must be kept constant?
 b) Use the results in the tables to work out the total mass lost after every 30 seconds.

Experiment 1

Time (s)	Mass (g)	Mass Lost (g)
0	100	0
30	99.8	
60	99.6	
90	99.4	
120	99.2	
150	99.0	
180	98.8	
210	98.6	
240	98.45	
270	98.30	
300	98.20	
330	98.15	
360	98.15	

Experiment 2

Time (s)	Mass (g)	Mass Lost (g)
0	100	0
30	99.7	
60	99.4	
90	99.1	
120	98.8	
150	98.6	
180	98.4	
210	98.3	
240	98.2	
270	98.15	
300	98.15	
330	98.15	
360	98.15	

Experiment 3

Time (s)	Mass (g)	Mass Lost (g)
0	100	0
30	99.0	
60	98.5	
90	98.3	
120	98.2	
150	98.15	
180	98.15	
210	98.15	
240	98.15	
270	98.15	
300	98.15	
330	98.15	
360	98.15	

- c) Plot the mass lost against time for all three experiments on the same axes.
 d) Which experiment was the fastest?
 e) Explain your answer to part d) in terms of particles and collisions.
 f) Why do all the graphs finish at the same point?
 g) Use the gradient (slope) of the graphs in the first 60 seconds to calculate the rate of the initial reaction for each experiment (mass lost \div time).
 h) Why does the gradient — and hence the rate — **DECREASE** as the experiment goes on?

- Q2** In terms of rates of reaction, explain these observations:

- a) milk keeps longer if put in the fridge.
 b) food lasts longer if stored in the freezer.

- Q3** Give five everyday or industrial examples of each of these:

SLOW reactions
(days or longer)

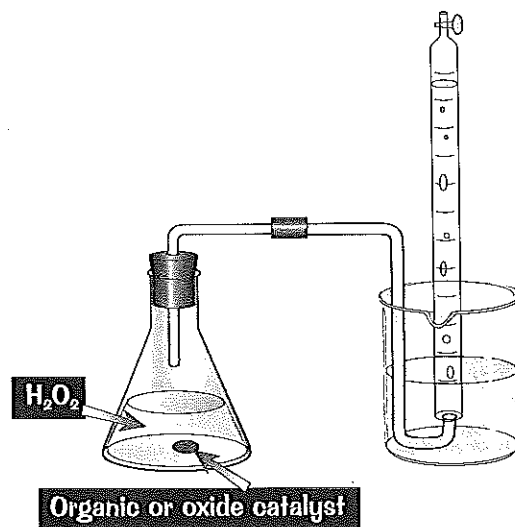
MODERATE reactions
(hours / mins)

FAST reactions
(seconds)

More on Rates of Reaction

- Q4** The decomposition of hydrogen peroxide (H_2O_2) to water and oxygen is very slow. However, it may be speeded up by using a suitable catalyst.

Time (s)	Volume of oxygen collected (cm^3)		
	MnO_2	CuO	Fe_2O_3
0	0	0	0
10	15	3	1
20	30	6	2
30	45	9	3
40	60	12	4
50	70	15	5
60	78	18	6
70	85	21	7
80	90	24	8
90	92	27	9
100	92	30	10

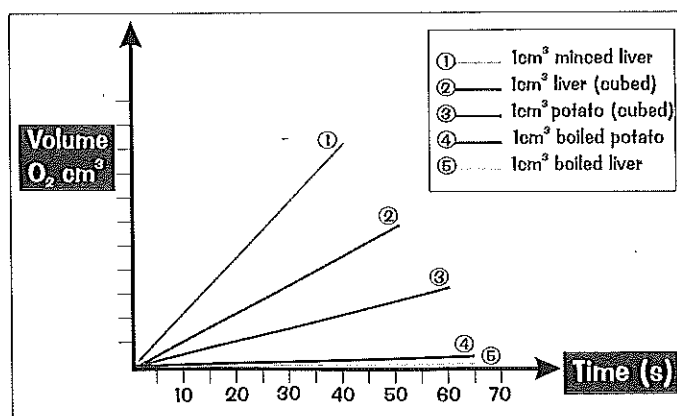


Use these results to plot three graphs on the same axes so that you can compare them easily.

- Which oxide is the best catalyst for this reaction?
- Give a reason for your answer.
- What is a catalyst?
- Explain briefly how catalysts are thought to speed up reactions.

- Q5** The breakdown of hydrogen peroxide may also be catalysed by enzymes in living cells, particularly those in liver and potato. Study the graphs below, which show typical results from such an experiment.

- Which of potato and liver contains the most effective enzymes?
- Which two graphs did you compare to answer (a)?
- What is the apparent effect of boiling the living tissue?
- Why is minced liver more effective than the liver cube?
- Enzymes are biological catalysts. State three facts you know about enzymes.
- Give two everyday or industrial uses of enzymes.



Top Tips:

Ouch, yet more graphs — but know your reaction rates and they won't hurt much. Just remember you can lose marks in the Exam for wonky points or lines — so get in the habit of plotting things carefully.